Remarks

Claims 1-20 were pending in the application. Claims 4, 5, 10-12, 19, and 20 were withdrawn from consideration. Claims 1-3, 6-9 and 13-18 were examined. Claims 1, 7, and 16 have been amended herewith for clarity and claims 21-27 have been added. Reconsideration is respectfully requested.

Rejections Under 35 U.S.C. § 112

Claim 16 was rejected as being indefinite for failing to point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Examiner indicated that there was insufficient antecedent basis for the recitation "said second netting" in claim 16. Applicant respectfully submits that the claim has been amended to reflect sufficient antecedent basis. Therefore, Applicant respectfully submits that the rejection to the claim should be withdrawn.

Objection to the Drawings

In response to the objection to the drawings, Applicant respectfully submits that the locking rings are located at the site of the bag rings. Applicant has included herewith a drawing sheet, entitled "Annotated Marked-Up Drawing", indicating the proposed changes in red and a replacement drawing sheet, entitled "Replacement Sheet" incorporating the proposed changes. The drawing sheets indicate the location of the locking rings 7 as requested by the Examiner. Entry of the proposed changes is respectfully requested.

Rejections Under 35 U.S.C. § 103

Claims 1-3, 6, 8, and 14-18 were rejected as being unpatentable over Jensen (U.S. Patent No. 7,723,360). This rejection is respectfully traversed.

With regard to claim 1, the Examiner states that disclosed in Jensen is "a fish bag means capable of transporting fish; a first and second bag ring (2 and 7); first and second netting means (read as the netting outside the rings (2 and 7) and an opening reducing means (5)." Office action, at 3.

Applicant respectfully submits that Jensen fails to teach or suggest that the opening reducing means (5 or 8) of Jensen is at a location between the fish bag means and the netting means. In Jensen it is seen that the each of the drawstrings, or opening reducing means of Jensen (as described by the Examiner), is located at the end of the net. Specifically, drawstring 5 is located at one end of the net and that the drawstring 8 is located at another end of the net.

The Examiner states that, "it would have been obvious to one having ordinary skill in the art at the time the invention was made to locate the opening reducing means [located] between said fish bag and said netting means, since it has been held that rearranging parts of an invention only involves routine skill in the art." Office action, at pages 2-3. Applicant respectfully submits that the present invention is not a mere rearrangement of parts of Jensen. The location of the means for controllably reducing an opening of said netting means, as claimed in independent claim 1, provides a new and unexpected result in that it allows for the regulation of the flow of water within the device resulting in the capability of transporting live fish at a speed between ten to twenty knots. Specifically, Applicant's specification recites, "[t]hrough these purse lines 5, 6 the fish bag 1 may be pursed and be closed at the end so that fish do not escape, but it will be possible to determine and regulate the through flow of water in the fish bag 1." Applicant's specification, at page 4, lines 23-26. Further, "[t]he purpose of the present invention is to provide a device being suited for

storage and transport of live fish for transport velocities far exceeding (10-20 knots) what the fish would endure outside the device…." Applicant's specification, at page 3, lines 19-22.

In prior art bags used to transport fish, "the towed keeping netting may not exceed a speed of 2-3 knots, something that is very time consuming" and, further, "[a] speed exceeding 2-3 knots will be stressing for the fish and will create conditions increasing the mortality." Applicant's specification, at page 3, lines 1-3 and 4-8.

Further, Jensen fails to provide any teaching or suggestion to modify its invention. Jensen does not disclose that it is concerned with transporting live fish at a particular velocity. In fact, Jensen was concerned with providing compartments for dividing fish based on ownership or size. Specifically, Jensen recite:

> In operation each fisherman may put his own catch into the compartment assigned to him, introducing the fish thereto through the corresponding neck, or one or more fishermen may put fish of one kind or size into one compartment and fish of another kind or size into another compartment of said net. In each event the fish will keep alive and fresh, and in one event the fish remain divided as to ownership or assorted as to kind or size. The net may then be anchored, if desired…. After fishing the nets may, if desired, be unlaced from each other and the ends of each gathered by its own drawstring. To remove the fish, they are preferably driven toward the gathered end of their compartment, and the net behind them is gathered in the hands, and the free end is lifted over a proper receptacle. The draw-string in the extreme end is then loosened, and part or all of the fish are dumped out into said receptacle, and the net is again closed and cast overboard. Jensen, col.2, lines 68-79.

Jensen fails to provide any teaching or suggestion to modify the invention. "Modification unwarranted by the disclosure of a reference is improper." *Carl Schenck, A.G. v. Nortron Corp.*, 218 USPQ 698, 702 (Fed. Cir. 1983). Here, Jensen fail to teach or suggest modification of the location of the opening reducing means, thus modification is improper. It is axiomatic in patent law that, "prior art references in combination do not make an invention obvious unless something *in the prior art reference* would suggest the advantage to be derived from combining the teachings." *In re Sernaker*, 217 U.S.P.Q. 1, 6 (Fed. Cir. 1983) (emphasis added). Nothing in the cited art teaches or suggests any advantage to be derived in the net of Jensen if the location of the opening reducing means were modified as claimed by Applicant. Therefore, for at least this reason, it would not have been obvious to modify Jensen to result in the claimed invention.

For at least the reasons presented above, claim 1 is novel and non obvious over Jensen. Therefore, for at least this reason, claims 2, 3, 6, and 21 (as well as withdrawn claims 4 and 5) which depend from claim 1, are novel and non obvious over the cited references.

Furthermore, claim 6 recites, "said fish bag means includes a tubular webbing material", not a netting. Jensen fails to teach or suggest that the Jensen "bag" as labeled by the Examiner, or net, as labeled by Jensen, is comprised of a webbing material. Therefore, for this additional reason, claim 6 is novel and non-obvious over Jensen.

With regard to claim 14, the Examiner stated, "disclosed is a tubular bag (1) formed of a webbing material; a bag ring (2 and 7); a netting outside the bag ring *and each end of the bag with a purse line* (5 and 8); a second purse line at the end of the netting (8)." Office action, at 4 (emphasis added). Applicant respectfully submits that claim 14 recites that there are two nettings in the claimed device. Each netting, of the two nettings, is equipped with two purse

lines in the device at the end of *each bag ring*. Jensen fails to teach or suggest that outside of the first bag ring 2 there is a netting equipped with two purse lines and that outside of the bag ring 7 that there is a netting equipped with two purse lines. Instead, Jensen disclose that there is netting outside of the bag ring 2 equipped with one purse line, or drawstring as labeled in Jensen, not two purse lines, as in the current invention. Further, Jensen discloses that there is netting outside of bag ring 7 equipped with one purse line, or drawstring as labeled in Jensen, not two purse lines, as in the current invention. For at least the reason that Jensen fails to teach or suggest that each netting outside of the corresponding bag rings is equipped with two purse lines, it fails to make obvious the present invention.

Specifically, Applicant's independent claim 14 recites, "outside of *each* bag ring and at *each* end of the tubular bag there being arranged a netting equipped with first and second purse lines, said first purse line disposed at a transition between said netting and webbing material of said tubular bag and said second purse line disposed at an end of said netting..." (emphasis added). Since Jensen fails to teach or suggest that *each* netting outside of the bag ring 2 or 7 is equipped with two purse lines, it cannot teach or suggest the location of both purse lines. In particular, Jensen fails to teach or suggest, with regard to each netting outside of the bag ring 2 or 7, a purse line at a transition between each netting and the tubular bag.

Further, Applicant respectfully points out that the Examiner appears to be confusing the bag with the netting, as the Examiner recites, "a netting outside the bag ring *and each end of the bag with a purse line* (5 and 8)..." whereas in Applicant's claim 14, *the netting* is equipped with first and second purse lines.

Additionally, the Examiner states that, "[i]t would have been obvious to one having ordinary skill in the art at

the time the invention was made to locate the first purse line at the transition between the webbing material and the netting, since it has been held that rearranging parts of an invention only involves routine skill in the art." Office action, at 4. As described above, Jensen fails to teach or suggest the presence and thus location of the second purse line. Through both the first and second purse lines, "the fish bag 1 may be pursed and be closed at the end so that fish do not escape, but it will be possible to determine and regulate the through-flow of water in the fish bag 1." Applicant's specification, at page 4, lines 22-25. Thus, having the purse strings, as arranged in Applicant's claimed invention produces a new and unexpected result.

Additionally, Applicant respectfully submits that the bag, as recited in claim 14, is comprised of webbing material, not a netting. Jensen fails to teach or suggest that the "bag" of its net, as labeled by the Examiner, is comprised of a webbing material.

Therefore, for at least these reasons, Applicant respectfully submits that claim 14 is novel and non-obvious over the cited prior art. Accordingly, withdrawal of the rejection is respectfully requested. Further, claims 15-18 (as well as withdrawn claims 19 and 20) depend from claim 14. Therefore, withdrawal of the rejection to these claims is respectfully requested for at least the same reasons as claim 14.

Independent claim 22 recites a netting arranged outside a bag. The netting has an inner end with an opening and an outer end with means for preventing fish from escaping. The inner opening is adjustable to regulate a flow of water through the bag. In contrast, Jensen fails to teach or suggest a netting with an adjustable inner opening. For at least this reason claim 22 is novel and non-obvious over the cited art. Accordingly, Applicant submits that claim 22 and claims 23-27, which depend from claim 22, should be allowed.

Rejections Under 35 U.S.C. § 102

Claims 7, 9, and 11 were rejected under 35 U.S.C. § 102(b) as being anticipated by Jensen. This rejection is respectfully traversed.

First, Applicant respectfully submits that, with regard to independent claim 7, there are purse lines, not a single purse line, at each end of the tube and outside of the bag rings. Specifically, claim 7 recites, "at each end of the tube there being arranged an open netting equipped with purse *lines* for adjusting the flow-through of water in the device by narrowing an opening" (emphasis added) In contrast, at each end of the net in Jensen there is a single drawstring. Therefore, for at least this reason Jensen fails to anticipate claim 7.

Further, claim 7 recites that the device comprises "a fish bag in the form of a tubular webbing material…." In contrast, Jensen fails to disclose use of a tubular webbing material. Therefore, for this additional reason, claim 7 fails to anticipate the claimed invention.

Further, Jensen fails to provide a teaching or suggestion to modify the its disclosure, thus, Jensen fails to make obvious the claimed invention. As claims 9 and 13 depend from claim 7 (as well as withdrawn claims 10 and 11), Applicant respectfully submits that these claims are novel and non obvious over Jensen for at least the same reasons as claim 7.

Additionally, dependent claim 13 recites "said fish bag includes a flexible material." Applicant respectfully submits that Jensen fails to teach or suggest the nature of the material which comprises the net, therefore, fails to anticipate or make obvious claim 13 for at least this reason.

Secondary Considerations

Applicant submits herewith a report prepared by the Norwegian Institute of Fishery and Sea Science, Ltd. and a certified English translation of the report. The report, which is not prior art, discusses the present invention, in particular each device of claims 1 and 22, and how the device overcomes problems associated with the prior art technology which, as indicated by the report, has barely changed for 50-60 years. An example of the present invention is depicted in Fig. 1 of the report. In particular the report indicates that prior art towing velocities are often as low as 1-1.5 knots, thus resulting in long arrival times. The report indicates that the need for more effective towing of a catch is large. The report states, "by regulating the opening at the rear end of the bag the penetrating current inside the bag may be selected." At picture 3, the report describes, "[i]n the transition between linen and webbing there are mounted purse lines with a rope making it possible to regulate the opening." Further, the report states that the device satisfies the goal for increased towing and that "the time for moving one's own catch is reduced with 75-80% as compared to traditional towing." The report indicates the success of the unique invention in overcoming long felt need for faster towing in the fishing industry.

Conclusion

For at least the reasons submitted above, Applicant respectfully submits that the claims are in condition for allowance. Accordingly, a Notice of Allowance is respectfully requested.

CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313

Signed: Sally Azevedo
Typed Name: Sally Azevedo

Date: August 2, 2004

Respectfully submitted,

Gina McCarthy

Gina McCarthy
Reg. No. 42,986

P.O. Box 2-E
San Jose, CA 95109-0005
(408) 297-9733

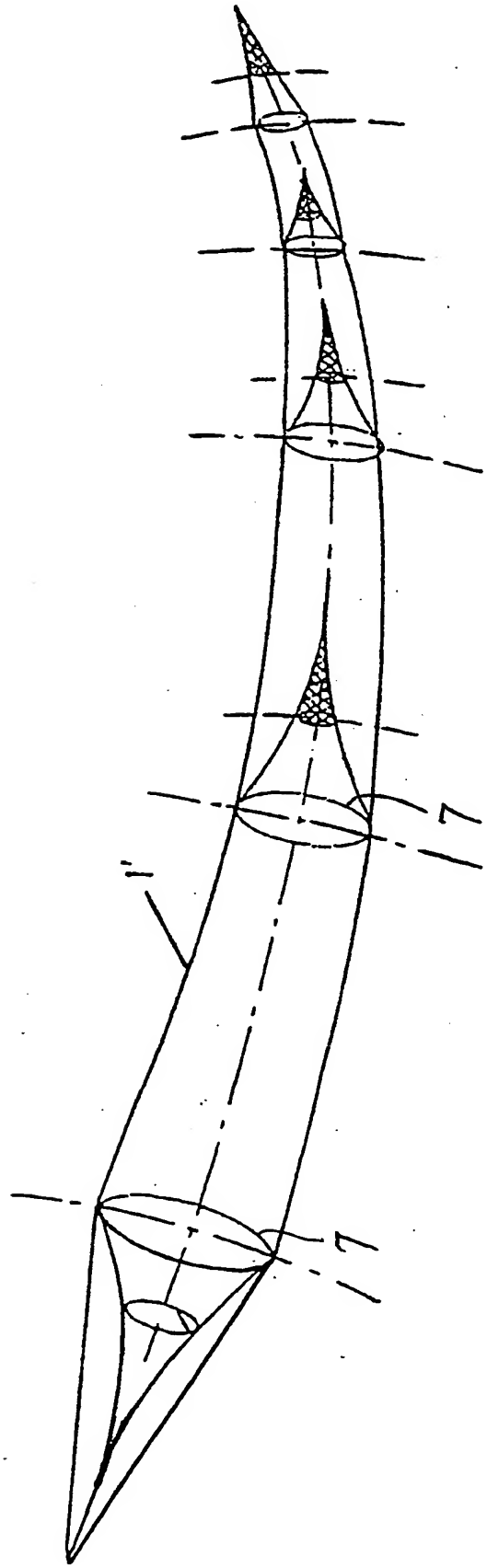


Fig.2

Fiskeriforskning

Norsk institutt for fiskeri- og havbruksforskning AS
Hovedkontor: Postboks 6122, 9291 Tromsø
Besøksadresse: Muninbakken 9-13,
Tlf.: 77 62 90 00, faks: 77 62 91 00
E-post: post@fiskeriforskning.no

Avd. Bergen: Kjerreidviken 16, 5141 Fyllingsdalen
Tlf.: 55 50 12 00, faks: 55 50 12 99
E-post: office@ssf.no

Internett: www.fiskeriforskning.no

Organisasjonsnr.: NO 964 441 898 MVA

RAPPORT

Tilgjengelighet: **Konfidensiell**	*Rapportnr:* 2004	*ISBN:*

Tittel: Sleping av levende sei i høy hastighet

Dato: 02. februar 2004

Antall sider og bilag: 12

Forfatter(e): Kjell Midling og Kåre Aas

Sign. forskningssjef:

Prosjektnr.: 6353

Oppdragsgiver: Fish Supply AS

Oppdragsgivers ref.:

3 stikkord: Slepepose, høy hastighet, fullskala test

Sammendrag: (maks 200 ord)

I prosjektet som beskrives i denne rapporten ønsket vi å evaluere slepeposens egnethet ved å gjennomføre tekniske og biologiske undersøkelser.

Resultatene fra undersøkelsen viser at vi ved å regulere åpningen bak på slepeposen, kan oppnå ønsket hastighet inne i posen. Strømmålingene inne i posen viser at med en åpning på 1,4 meter i diameter er hastigheten 0,5 meter per sekund. Dette tilsvarer ca. en kroppslengde til seien som skulle transporteres. Samtidig ble hastigheten på slepet, og derved også den utvendige vannstrømmen på posen, målt til 2,5 meter per sekund (5 knop).

Posen, slik den fremstår i dag, tilfredsstiller målet om økt slepehastighet. Med over fem knop slepehastighet er tid til flytting av egen fangst redusert med 75-80 % sammenlignet med tradisjonelle slep. Det er også to knops forbedring i forhold til forsøkene i 2002. Kapasiteten i den omarbeidde posen er minst 30 tonn. De grunnleggende målene for posen er derved nådd.

English summary: (maks 100 ord)

The towing cylinder is assembled, set afloat or taken onboard in less than 15 minutes. The cylinder inflates and become taut at a towing speed of less than one knot. The purse-seiner was able to tow the cylinder at 5,5 knots. Water velocity inside the cylinder was 20 % of towing velocity (1 knot inside the cylinder when towed at 5 knots). By concentrating the catch in the seine, the fish swim from the seine to the cylinder through the transfer tunnel.

1 INNLEDNING

Transport av levende fisk i Norge er særlig knyttet til brønnbåttransport av oppdrettet fisk (laks og ørret), fangst av levende torsk (snurrevadflåten) og sleping av pelagisk fisk (sei). Andel av notfanget sei som settes i lås har gått ned de senere år, fra 11 000 tonn i 1999 til 3 000 tonn i 2002. Dette skyldes kapasitetsøkningen i større kystnotfartøy (over 90 fot) som transporterer seien på egen kjøl, bedre organisering av uttaket (seistopp i juli), og endringer i kvoter og tilgjengelighet.

Den største andelen av de ca 200 kystnotfartøyene (mellomstore og mindre kystnotfartøy) har imidlertid fortsatt behov for å transportere seien fra feltet til lagringsplass i tradisjonelle slepeposer. Disse posene har en kapasitet på 40 til 80 tonn og består av en rektangulær pose av notlin, spisset i begge ender, og med tverrgående stenger for avstiving. I den aktre enden av posen er det mulig å slippe ut død, eller døende sei. Hastigheten på slepet begrenses av fartøyets slepekraft, posens styrke og seiens evne til å svømme. Da slepehastighetene ofte er så lave som 1-1,5 knop (50 til 75 cm/sekund) kan det ta svært lang tid å komme seg fra feltet til lagringsplassene. Teknologien er gammel og lite endret de siste 50-60 år.

Behovet for mer effektiv sleping av egen fangst er stort, både fra feltet og til prosessindustrien. Gjennom firmaet Fish Supply AS har oppfinnerne Inge Henning og John Ingar Jenssen utviklet en ny konstruksjon slepepose, først som modell (en meter lang) i tank, deretter skalamodell (åtte meter lang) på eget fartøy. Ved sistnevnte test høsten 2000, bisto Fiskeriforskning med strømmålinger og atferdsobservasjoner.

Den nye transportteknologien retter seg i hovedsak mot seinæringen, men teknologien har åpenbare anvendelser også innen oppdrettsnæringen (laks og torsk). Seinæringen er likevel per dato mer interessant på grunn av mange og små enheter. Prinsippet bak posens funksjon er enkelt; ved å regulere åpningen bak i posen kan gjennomstrømningen inne i posen bestemmes. Reguleringen kan gjøres (nesten) uavhengig av slepehastighet og gjør det teoretisk mulig å slepe levende fisk ved høye hastigheter og samtidig gi fisken gode forhold inne i posen. Eksempelvis er det gjennomført tester hvor posen ble slept i 5 knop (2,6 meter per sekund) mens vannhastigheten inne i posen ble redusert til 1 knop (0,5 meter per sekund).

Høsten 2002 ble det i regi av Fiskeriforskning gjennomført fullskala test med en slepepose på 700 m^3 ("Fullskala uttesting av slepepose for levende fisk", av Kåre Aas og Kjell Ø. Midling, oktober 2002, konfidensiell rapport fra Fiskeriforskning). Basert på erfaringene fra 2002 ønsket man å gå videre med uttesting slik at slepeposen kunne utvikles til et produkt for Fish Supply AS.

2 MÅLSETTING

I prosjektet som beskrives i denne rapporten ønsket vi å evaluere slepeposens egnethet ved å vurdere følgende problemstillinger:

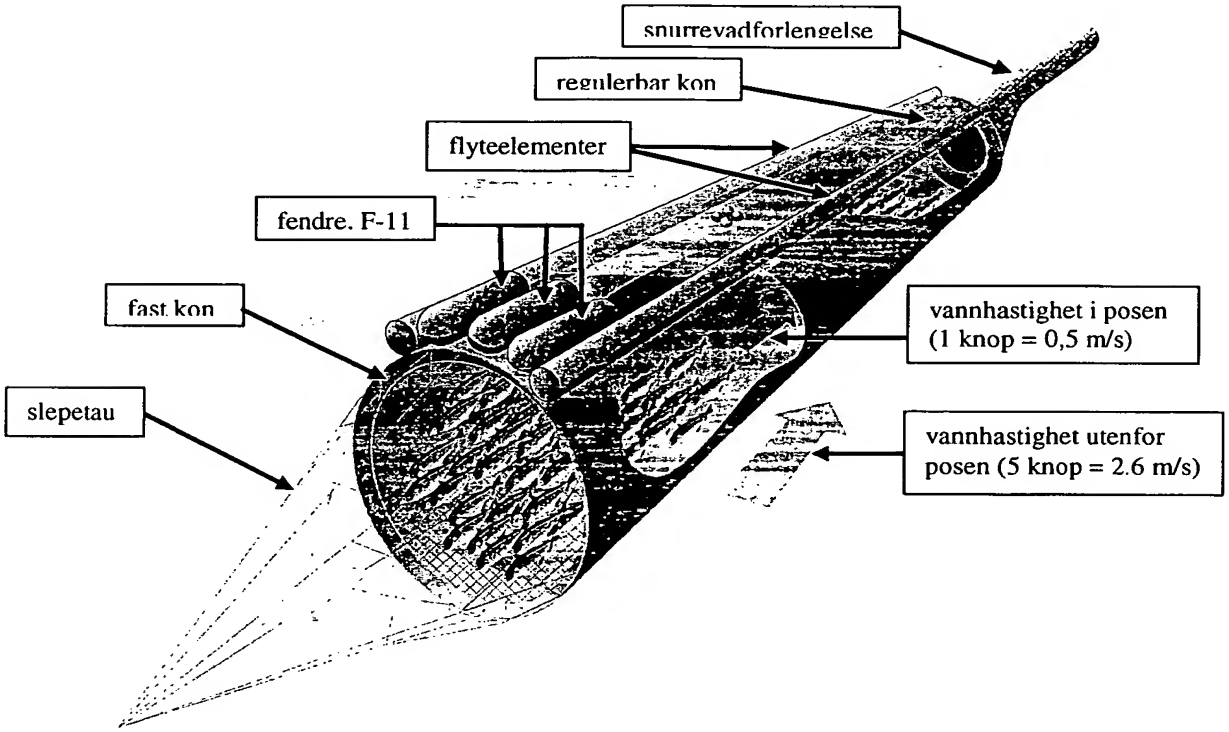
- Evaluere seleksjonsteknikker i not under fangst og i pose under slep
- Utvikle ny slepepose, inkludert instrumentering, ny overføringskanal og seleksjonspanel, med kapasitet på inntil 50 tonn i samarbeid med Protan AS
- Finne optimal (maksimal) tetthet med 150 kg/m^3 som øvre grense
- Beskrive seiens normale atferd og reaksjoner på miljøendringer i posen (lys, oksygen og svømmehastighet)
- Måle seiens fysiologiske status før, under og etter slep
- Sammenligne kvalitet (spesielt rester av blod i filet) hos trålfanget sei, brønnbåttransportert- og posetransportert sei.

3 AKTIVITETER OG RESULTATER

Erfaringer fra aktiviteten som beskrives under førte til at den 50 meter lange posen ble forkortet til 25 meter. Endringen førte til en reduksjon i kapasitet fra 60 til 30 tonn levende fisk. I fortsettelsen beskrives derfor aktiviteten og resultatene som fase 1 og 2 for uttesting uten fisk.

3.1 Begrepsavklaring

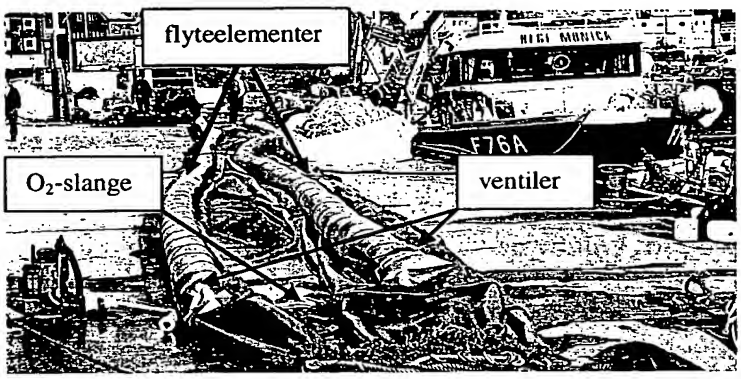
Figur 1 beskriver oppbygging og plassering av hovedkomponentene i slepeposen.



Figur 1: Prinsippskisse av slepeposen med hovedkomponenter.

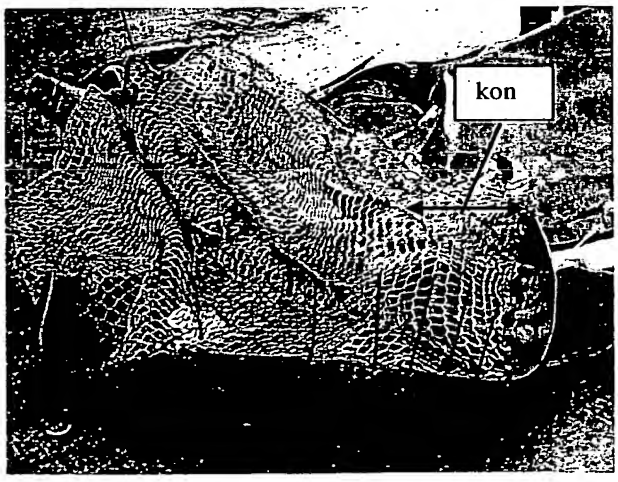
3.2 Fase 1: Slep uten fisk, 60 tonn kapasitet

Flyteelementer og oksygenslanger ble montert mens posen var strukket ut på land (bilde 1). På begge sider av posen var det sveiset inn tre langsgående kammer med forsterkede hull. Denne løsningen ble valgt for å kunne variere hvor flyteelementene skulle festes. For at posen skulle oppnå tilnærmet sylindrisk form (10 meter omkrets) under bruk, ble flyteelementene festet slik at de var nærmest mulig toppen av posen. Avstanden mellom elementene (senter-senter mål) var 1,9 meter. Flyteelementene ble blåst opp før de ble leiset fast til to av kammene, en på hver side av elementet. Luftfylleventilene ble plassert vendt opp ved akterenden av posen.



Bilde 1: Posen, sett bakfra, strukket ut på kai for montering av flyteelementer. I bakkant vises ventiler for fylling og tømming av luft.

Fra uttestingen høsten 2002 erfarte man at oksygennivået i posen i forbindelse med inn og utlasting ble lavere enn ønsket. Det ble derfor bestemt at denne versjonen skulle utstyres med diffusorslanger for å kunne tilsette oksygen inne i posen. Diffusorslangen (100 meter) ble delt i to, lagt dobbelt og koblet slik at det kunne tilføres oksygen i fremre og bakre halvdel av posen, avhengig av behovet. Tilførselsslangene ble ført til toppen av posen gjennom en egen åpning, en meter fra slepeposens bakre åpning (bilde 1). Under håndtering skulle oksygenet tilføres fra flasker montert i en gummibåt på toppen av slepeposen. Systemet ble ikke benyttet under testene som beskrives her.

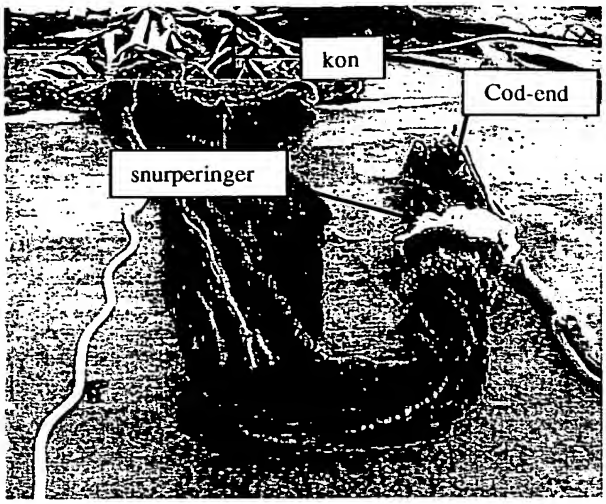


Innvendig foran på posen ble det montert en kon (30 cm dyp, 45° vinkel) som skulle sørge for at posen åpnet seg hurtig selv ved lav vannstrøm. Det ble i tillegg montert et nett tilpasset fremre åpning på posen (bilde 2). Linet ble valgt ut fra forventet størrelse på seien som senere skulle transporteres i posen.

Bilde 2: Nett og innvendig kon montert i front av posen. Maskestørrelsen er valgt ut fra forventet størrelse på seien som senere skulle transporteres.

Linet i snurrevadforlengelsen bak i posen ble valgt etter samme kriterier (bilde 3). Snurrevadforlengelsen ble valgt fordi den har en form og funksjon som tilsvarer det man ønsker å ha i slepeposen. I forlengelse av bakre del av slepeposen ble det montert inn en kon

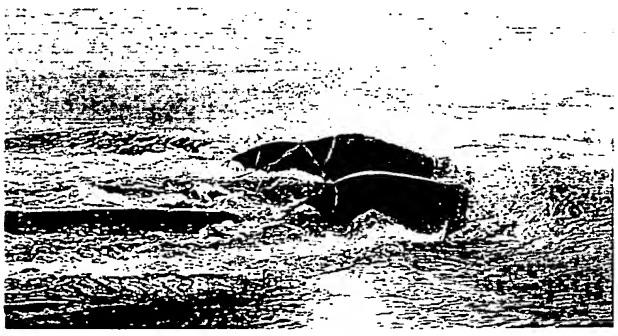
(1,2 meter dyp) som reduserte åpningen fra 10 til 8,4 meter i omkrets. I tillegg ble det montert snurperinger på linet for å kunne redusere åpningen ytterligere.



Bilde 3: Snurrevadforlengelse ferdig montert akter på posen. I overgangen mellom lin og duk er det montert snurperinger med tau som gjør det mulig å regulere åpningen.

Utformingen av slepetauene har stor betydning for posens funksjon. Asymmetri og skjevheter fører til at posen blir ustabil. I prinsippet bygges slepetauene slik at det er mange festepunkter i posen og at antallet halveres (med hanefot) til det går sammen til et enkelt slepetau. For hver hanefot forlenges sleperen med to ganger diameteren på posen (tilsvarende 6,4 meter). Det ble laget 12 korte haneføtter (ca. 1 meter) fordelt og festet i posen (totalt 24 punkter), fra disse ble det montert 6 nye haneføtter som igjen ble fordelt på 3 til. Disse tre ble festet i en stålring som var festet til slepetauet fra båten. Total lengde fra posen til slepetauet fra båten blir således 12 meter.

Posen, ferdig montert, ble sjøsatt og klargjort for slep. Etter en tids sleping med økende fart på båten, viste det seg at fremre del av posen gikk ned. Dette medførte at luften i flyteelementene ble forskjøvet bakover og at trykket dermed økte. Etter kort tid sprengte elementene ved ventilene. Slepet ble avbrutt og posen tatt om bord for transport til land. For å motvirke kreftene som førte til at posen ble dradd under vann, ble det montert tre standard fendre (F-11, ca 150 liter hver) mellom flyte-elementene foran på posen (bilde 4). I tillegg ble nedre del av kon (ca 25 % av omkretsen) foran i posen skåret opp (inaktivert).



Bilde 4: Fendre montert i fronten av posen.

De skadede områdene etter sprengningen ble skåret av og nye ventiler ble montert inn før flyteelementene ble sveiset igjen. Under trykkprøving etter reparasjonen fant man flere små hull som ble lappet ved sveising. Disse hullene hadde trolig oppstått som en følge av at posen ble dratt langs kaidekket i forbindelse med monteringen. Erfaringen viser at flyteelementene må beskyttes i egne kanaler og integreres i selve posen. Det vil da være mulig å bytte ut

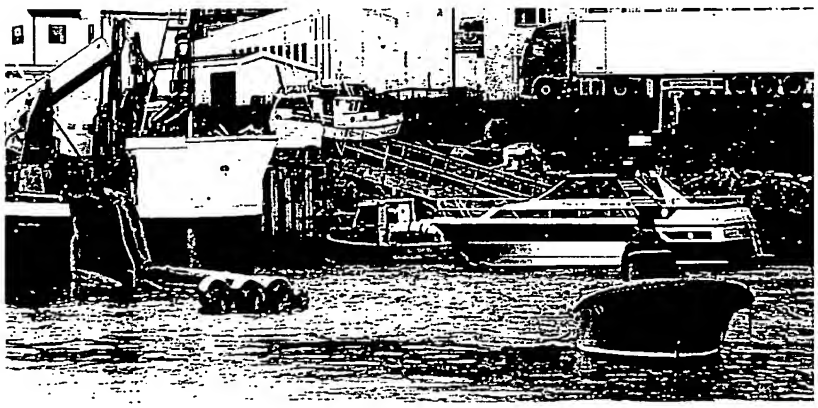
flyteelementene raskt ved behov. Som en følge av lavt trykk i elementene ble det under sleping observert tilfeller hvor innfestingstauene helt eller delvis hindret luften fra å fordele seg fritt i lengderetningen av flyteelementene. Dette ville også unngås dersom elementene ble plassert i lukkede kammer.

Etter reparasjon og modifisering var det problematisk å få posen til å åpne seg slik den skulle. Dette var en følge av for lite luft i flyteelementene og for stor åpning bak. Luft ble etterfylt, mens åpningen bak ble redusert fra 2,7 til 2 meter i diameter. Etter denne justeringen åpnet posen seg raskt og fyltes i hele lengden. Etter at farten på slepet ble økt til 4 knop (tilsvarende 2 meter per sekund) oppstod det "slangebevegelser" i posen (bakre del svinger frem og tilbake). Denne effekten ble mindre ved ytterligere å redusere åpningen bak, men oppstod fortsatt etter krappe svinger. Slangebevegelsen oppstår fordi posen i en krapp sving "knekker". Åpningen i "knekk-punktet" er nå mindre enn posens bakre åpning, og bakre del av posen tømmes. Når posen igjen er rettet ut, fylles den igjen, men slangebevegelsen kan fortsette i 10 til 15 minutter. Vi mener at "slangebevegelsen" er en følge av at posens diameter blir for liten i forhold til posens lengde. Under siste fase av dette slepet ble det oppnådd en hastighet på 5,6 knop (2,9 meter per sekund). Det ble ikke gjennomført målinger av vannhastigheten inne i posen under denne fasen av testen.

Erfaringene fra den siste testen viste at posens hydrodynamiske egenskaper ble betydelig forbedret ved å feste inn tre fendre foran på posen. Samtidig ble det observert problemer med å holde fasongen på posen selv med svært redusert åpning bak. Forholdet mellom åpningens diameter og posens lengde er 1:16, mens det på posen som ble testet høsten 2002 var 1:8. Det ble også erfart at posen, selv etter å ha blitt tatt om bord med triplex og pakket så godt det lot seg gjøre, tok for stor plass. Det tok 15 minutter å få om bord posen på 50 meter, noe som tilsvarer tiden det ville tatt å tømme posen for fisk. For de videre forsøkene ble det derfor besluttet at posens lengde skulle halveres.

3.3 Fase 2: Slep uten fisk, 30 tonn kapasitet

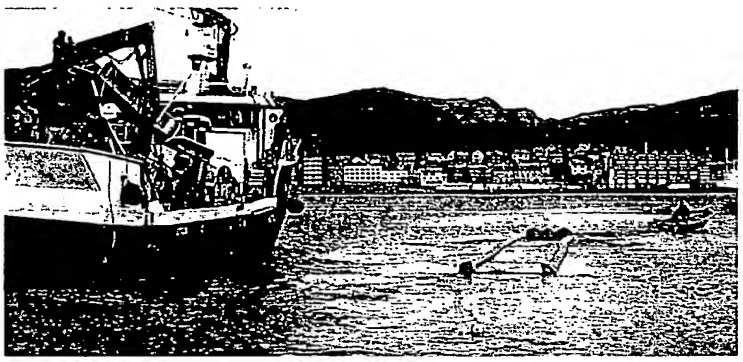
Vi valgte å redusere posens lengde fra 50 til 25 meter, og endte dermed opp med et forhold mellom åpning og lengde på 1:8. Samtidig ble posens totale vekt redusert fra 1400 til 800 kilo (anslåtte verdier). Posens lengde ble redusert ved at en seksjon på 25 meter i midten ble fjernet. Front og endestykke ble sveiset sammen. En av diffusorsløyfene for tilførsel av oksygen i posen ble fjernet, mens den andre ble tilpasset den nye utformingen på posen. Kon i front av posen, som i første fase delvis ble inaktivert (beskrevet i foregående avsnitt), ble reparert.



Posen fikk nå plass på babord side ved lettbåten. Fra denne posisjonen klarte lettbåten å trekke posen ut slik at mannskapet på båten kunne fylle flyteelementene med luft (bilde 5).

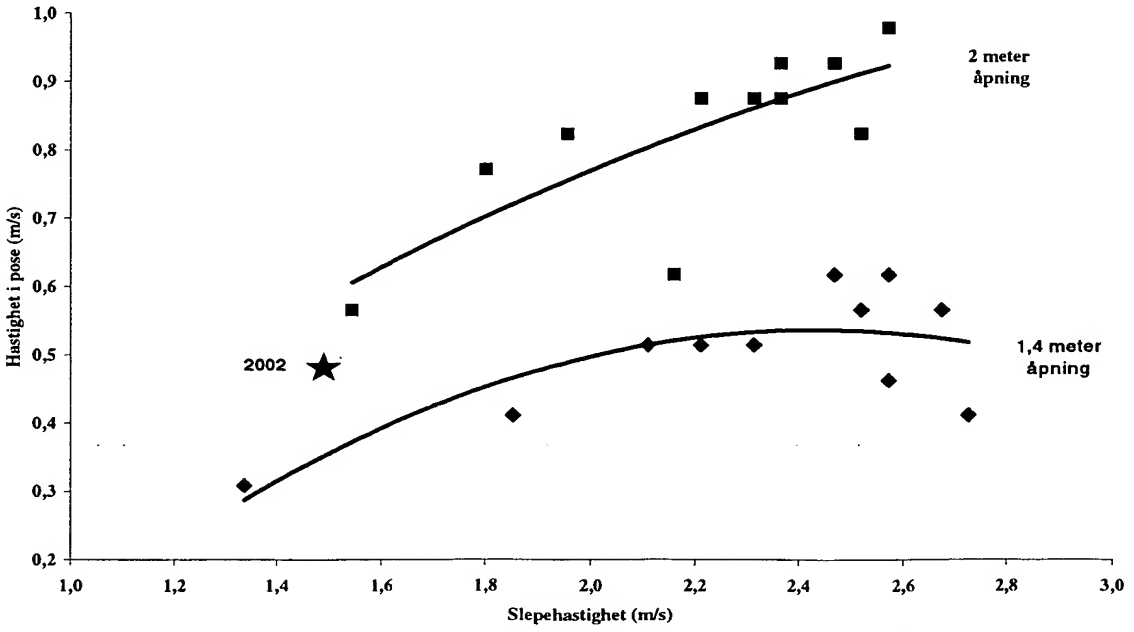
Bilde 5: Utsett av pose med lettbåt.

Bruk av bensindrevet luftblåser har vist seg ikke å være optimalt. Ved enkelte tilfeller har det vært vanskelig å få start, i tillegg er man avhengig av å operere både blåseren og ventilene samtidig. Disse forholdene kan under uheldige omstendigheter føre til at det tar for lang tid å få oppdrift i slepeposen, som igjen kan føre til at posen begynner å synke. Dersom posen skal brukes til slep av fisk direkte fra not vil det være viktig at klargjøring av slepeposen tar minimalt med tid. Tar det for lang tid kan det oppstå dødelighet i nota. Muligheten for alternative løsninger på flyteelementene bør vurderes i videre utvikling av produktet.



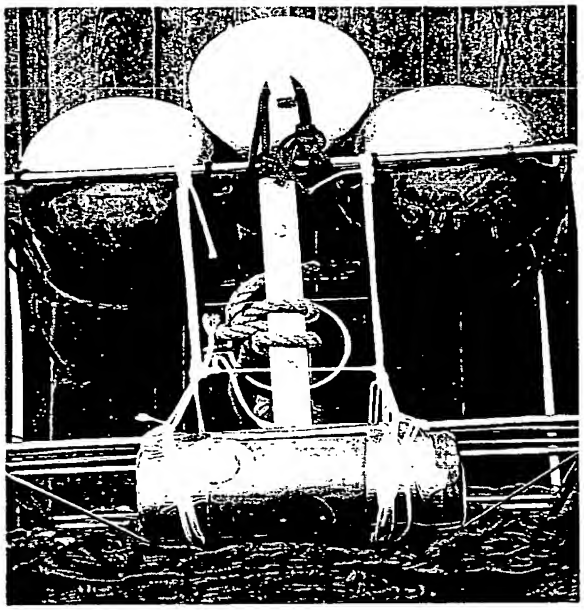
Bilde 6: Lettbåten sleper med 1 knops fart. Posisjon og form på flyteelementene viser at posen er fylt.

Etter ombygging av posen ble den sjøsatt ved hjelp av lettbåten. Posen åpnet seg og fyltes umiddelbart etter at den ble frigjort fra MS Hege Monica. GPS-loggeren på følgebåten ("Kobben") viste at lettbåten klarte å slepe posen i ca 1 knops fart (bilde 6). Etter å ha testet posen en kortere distanse fant vi at den fungerte optimalt både med tanke på hurtig fylling og hydrodynamiske egenskaper.



Figur 2: Strømhastighet inne i slepeposen ved ulike slepehastigheter. Målingene er utført med 2 og 1,4 meter åpning bak på posen. Hastigheten er beskrevet som meter per sekund, hvor 1 meter per sekund tilsvarer 1,94 knop. Stjerne indikerer resultatene oppnådd i testen høsten 2002.

Etter denne innledende testen ble Scanmar- strømmåler (Scanmar gridsensor HC4 GS-01, bilde 7) montert 10 meter fra akterenden på posen. Denne sensoren overførte strømmålinger trådløst fra innsiden av posen til en mottaker slept etter båten på to meters dyp, to meter fra skutesiden. Registreringen ble avlest på egen logger plassert i styrhuset på "Hege Monica". Det ble gjennomført to slepesekvenser hvor bakre åpning var henholdsvis 2 og 1,4 meter i diameter (figur 1). Med en bakre åpning på 1,4 meter var strømhastigheten inne i posen 0,5 m/s (1 knop), mens båten holdt en fart på 2,6 m/s (5 knop). Ved samme hastighet på båten, men med en åpning på 2 meter, var farten innvendig i posen økt til 1 m/s (2 knop). Etter at målingene var gjennomført ble posen tatt om bord i løpet av 6,5 minutter.



Bilde 7: Rigg med Scanmar strømmåler for måling av vannhastighet inne i slepeposen.

Resultatene viser at vi ved å regulere åpningen bak, kan oppnå ønsket hastighet inne i posen. I dette tilfellet hadde vi som mål å transportere notfanget sei med en antatt størrelse på 50 cm (ca. 1 kilo) med en strømhastighet tilsvarende en kroppslengde per sekund. Figur 1 viser at med en åpning på 1,4 meter diameter er hastigheten inne i posen tilnærmet en kroppslengde, det vil si 50 cm. Hastigheten på slepet vil være 2,5 meter per sekund (5 knop). Sammenliknet med sleping i tradisjonelle poser gir den nye slepeposen 4 til 5 ganger høyere hastighet. I praksis medfører dette at et slep som tidligere tok 30 timer vil det nå, ved å bruke den nyutviklede slepeposen, være mulig å gjennomføre på 6 til 7,5 timer.

3.4 Slep med 20 tonn sei i posen

I uke 41 skulle de siste forsøk gjennomføres. Primo oktober er helt i slutten av seifisket og mange av kystnotfartøyene hadde gjort seg klar for sildefisket i Vestfjorden. Eneste leveringsmulighet i området (Vest-Finnmark) var to russiske fabrikkfartøy i nærheten av Hammerfest.

Etter noen bomkast fikk vi et kast på ca 30 tonn (anslått etter at fangsten var tørket langs skipssiden). Selv om det bare hadde tatt 10-12 minutter tidligere å få ut slepeposen fikk vi denne gangen problemer med start av luftblåser til luftfylling. Det tok derfor mer enn 25 minutter før posen var sjøsatt ved hjelp av lettbåt. Posen ble deretter slept rundt MS Hege Monica og i posisjon for montering til nota. Innsying av overføringskanal fra not til slepepose tok også lengre tid enn beregnet. Alt i alt hadde seifangsten på ca 30 tonn ligget ved skipssiden i ca en time før fisken endelig var overført til slepeposen, delvis passivt, delvis svømmende. Det var anslagsvis 2-3 tonn sei som lå igjen flytende bak i snurrevadforlengelsen når slepet startet.

Seien søkte frem i posen umiddelbart etter at slepet var satt i gang. Kamerainspeksjon foran posen viste at seien stod tett helt fremme ved notpanelet. Det var relativt stor innblanding av sei rundt 40 cm og dette førte til at ca 40% av seien ble selektert gjennom panelet foran og

overføringskanalen. Dessverre hadde også en del av seien satt seg fast i notpanelet. Slepet foregikk normalt, men siden det nå var blitt mørkt ble ikke posen slept i hastigheter over fire knop.

Tømming av slepeposen ble utført med fiskepumpe, montert i enden av overføringskanalen, mens slepeposen ble tørket gjennom Triplex. Tømmingen gikk raskt og effektivt og fangsten ble deretter levert til fabrikkskipet.

Dessverre ble det med dette ene fullskala forsøket. Svarene er imidlertid tilfredsstillende for de mest sentrale problemstillingene, mens andre nok trenger gjentakelse i 2004.

4 KONKLUSJONER

4.1 Hastighet

Posen, slik den fremstår i dag, tilfredsstiller målet om økt slepehastighet. Med over fem knop slepehastighet er tid til flytting av egen fangst redusert med 75-80 % sammenlignet med tradisjonelle slep. Dette er to knops forbedring i forhold til forsøkene i 2002. Kapasiteten i den omarbeidde posen er minst 30 tonn. De grunnleggende målene for posen er derved nådd.

4.2 Konstruksjon

For selve hoveddelen av posen, sylinder og "koner" i begge ender, er vi fornøyd med dagens konstruksjon. Forholdet mellom diameter og lengde er 1:8. Forholdet mellom åpningsareal fremme og bak på 5:1 (8 m^3 fremme og 1,5 m^3 bak) reduserer farten utenfor og inne i posen med samme forhold (fem knop slepehastighet gir én knop inne i posen). For reduksjon i andre deler av fartsområdet, se figur 2.

4.3 Valg av materiale i posen

Det valgte materialet i 2003-forsøkene er fortsatt for tungt og voluminøst. Selv med redusert posestørrelse blir den uhåndterlig og tar for mye plass om bord i fartøyet. Dette materialet er også uforholdsmessig dyrt og totalkostnadene for en 40-tonns pose fortsatt er utenfor realistisk betalingsvillighet i flåten (NOK 150.000,-). Priser innhentet i 2003, fra nye produsenter og ved bruk av alternative materialer (airbag-duk), indikerer at en 40-tonns pose kan produseres for mindre enn NOK 40.000,- eksklusive notlin og tauverk. Dette vil være en konkurransedyktig pris.

4.4 Overføring, notlin og seleksjon

Erfaringene med overføring av fisk fra not til slepepose ble meget begrenset. Imidlertid ble det avdekket at overføringskanalen (snurrevadforlengelsen) er for lang, men funksjonell dersom man får montert posen raskt nok (maksimum 15 minutter etter avsluttet notkast). Notlin brukt i overføringskanal og panel fremme hadde for store masker. Dessuten "kledde" seien maskene. Dette tilsier at seleksjonsområdene bør utformes som panelet etter trålmodell (flexirist eller firkantlin –Ultra Cross).

5 FORSLAG TIL VIDERE FRAMDRIFT

Erfaringene fra uttestingen av slepeposen viser at den som produkt må videreutvikles for å effektivisere overføring av fisk og tilpasse seleksjonspaneler som fjerner undermåls / små fisk. Dette er en jobb vi tror best kan gjennomføres i et samarbeid mellom Fish Supply AS, Havforskningsinstituttet ("Ansvarlig fiske") og kystnotfiskere som ønsker å ta i bruk den nye teknologien.

I gjennomføringen som er beskrevet i denne rapporten, ble det fokusert på å utvikle en funksjonell slepepose. Dette medførte uforutsette hendelser i form av ombygging og reparasjoner før posen fungerte tilfredsstillende. Den planlagte aktiviteten knyttet til fysiologiske og kvalitetsmessige undersøkelser av sei i posen ble derfor nedprioritert. Fiskeriforskning anser dette som viktig å få gjennomført, og håper derfor å få gjøre denne jobben i senere prosjekter.

- Det lyktes ikke å kombinere fangst/sleping med lagring/fôring i 2003 (FHF-prosjekt "Lagring og fôring av sei"). Seien som ble fanget høsten 2003 var for liten og derfor av liten interesse for bearbeidingsindustrien (i hovedsak i Vesterålen). Innenfor de resterende midler i prosjektet som beskrives her har vi valgt å produsere en mindre utgave av posen (1,5 meter i diameter og 12 meter lang) i "air-bag" duk. Denne posen har fast oppdrift og vil ha en kapasitet på ca. 4 tonn fisk. Med en slik pose vil vi være i stand til å gjennomføre studier på flere av artene (laks, torsk, makrell, sild og tunfisk) som kan være aktuelle for transport med den nye teknologien. Vi håper på denne måten å framskaffe kunnskap som kommer slepeposen som produkt til gode, både nasjonalt og internasjonalt. I tillegg vil en slik aktivitet gi viktig kunnskap om nye metoder for levende transport av fisk.

Fiskeriforskning

Besøksadresse Tromsø:
Muninbakken 9, Breivika
Postadresse: N-9291 Tromsø
Telefon: 77 62 90 00
Telefaks: 77 62 91 00
E-post: fiskforsk@norut.no

Besøksadresse Bergen:
Kjerreidviken 16
Postadresse: N-5141 Fyllingsdalen
Telefon: 55 50 12 00
Telefaks: 55 50 12 99
E-post: office@ssf.no

Internett: http://www.fiskforsk.norut.no

VERIFICATION OF TRANSLATION

I, Trond Gustad, of Ragnhild Schibbyes vei 1, N-0968 Oslo, Norway, holding a Master of Science Degree in Biochemistry, being a Patent Agent, and being well versed in the English and Norwegian languages, hereby certify that the annexed document is a true translation of a report issued by the Norwegian Institute of Fishery and Sea Science, Ltd. on February 2, 2004.

Oslo, this 2nd day of August, 2004

Trond Gustad

Trond Gustad

"In the project being described in this report we wished to evaluate the suitability of the towing bag by conducting technical and biological tests.

The results from the investigation show that by regulating the aperture at the rear end of the towing bag, it may be obtained a wanted speed inside the bag. The flow measurements inside the bag show that with an opening of 1.4 meters in diameter the speed is 0.5 meters per second. This corresponds to about one body length of the pollack to be transported. Simultaneously the speed of the towing, and thereby also the external water current on the bag, measured to 2,5 meters per second (5 knots).

The bag, as it appears today, satisfies the goal for increased towing velocity. With over five knots towing speed the time for moving ones own catch is reduced with 75-80 % as compared to traditional towing. This is also an improvement of two knots in relation to the tests in 2002. The capacity of the redesigned bag is at least 30 tons. The basic goals for the bag are thus achieved."

The translation of page 1 is as follows:

"1 **INTRODUCTION**

Transport of live fish in Norway is especially related to well-boat transport of cultivated fish (salmon and trout), catch of live cod (the Danish seine fleet) and towing of pelagic fish (pollack). The portion of seine catch which is put under lock has in the latter years decreased, from 11 000 tons in 1999 to 3 000 tons in 2002. This is caused the capacity increase of lager coastal seine ships (over 90 feet) transporting the pollack in their own keel, a better organization of the out-take (stop in pollack in June), and changes in quotas and accessibility.

The larger part of the about 200 coastal seine ships (medium and small coastal seine ships) have, however, still a need for transporting the pollack from the field to a storage site in traditional towing bags. These bags have a capacity of 40 to 80 tons and consist of a rectangular bag of seine linen, pointed at both ends, and with transversal poles for bracing. At the rear end of the bag I is possible to exit dead or dying pollacks. The speed of the towing is limited by the towing power of the vessel, the strength of the bag and the swimming capacity of the fish. Since the towing velocities often are as low as 1-1.5 knots (50 to 75 cm/second) it may take a very long time to arrive at the storage sites from the field. The technology is old and has barely been changed for the 50-60 years.

The need for a more effective towing of one's own catch is large, both from the field and to the process industry. **Through the company Fish Supply AS the inventors Inge Henning and John Ingar Jenssen have developed a new construction of a towing bag, first as a model (one meter long) in tank, and thereafter a scale model (eight meters long) on their own vessel. At the latter test in the fall 2000, the Fishery Science assisted with current measurements and behavioural observations.**

The new transport technology is directed mainly towards the pollack industry, but the technology has obvious uses also within the fish-raising industry (salmon and cod). The pollack industry is still per date more interesting on account of many and small units. The principle behind the function of the bag is simple: by regulating the opening at the rear end of the bag the penetrating current inside the bag may be selected. The regulation may be done (almost) independent of the towing speed and makes it theoretically possible to tow live fish at high velocities and simultaneously provide the fish with good conditions inside the bag. As an example there have been conducted tests wherein the bag was towed at 5 knots (2.6 meters per second) while the water velocity inside the bag was reduced to 1 knot (0.5 meters per second).

In the fall 2002 there was under the direction to Fish Science performed a full scale test with a towing bag of 700 m^3 ("Full scale testing of towing bag for live fish" by Kaare Aas and Kjell OE. Midling, October 2002, confidential report from Fishery Science). Based on the experience from 2002 it was a wish to proceed further with testing so such a towing bag could be developed to a product for Fish Supply AS."

Translation page 2:

"2 **Goals**

In the project being described in this report, we wanted to evaluate the suitability of the bag by considering the following problems:

- Developing selection techniques in a seine during catch and in a bag during towing

- Developing a new towing bag, included instrumentation, a new transfer canal and selection panel, with a capacity of up to 50 tons in cooperation with Protan AS

- Find optimal (maximal) density with 150 kg/m^3 as an upper limit

- Describe the normal behaviour of the pollack and reactions to environmental changes inside the bag (light, oxygen and swimming velocity)

- Measure the physiological status of the pollack prior to, during and subsequent to the towing

- Compare the quality (especially remains of blood in the filet) in trawl-caught pollack, well-boat transported and bag-transported pollack."

Translation page 3:

"3 **ACTIVITIES AND RESULTS**

Experiences from the activity being described infra led to the 50 meters long bag being shortened to 25 meters. The change led to a reduction in capacity from 60 to 30 tons live fish. Consequently infra there is described the activity and result as in phase 1 and 2 for testing without fish.

3.1 Definition of terms

Figure 1 describes the design and location of the main components in the towing bag.

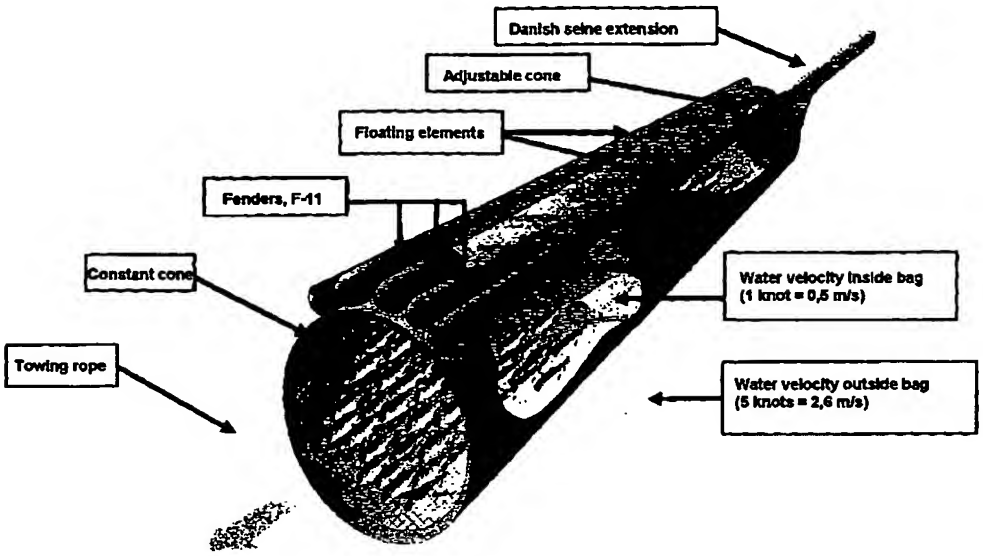
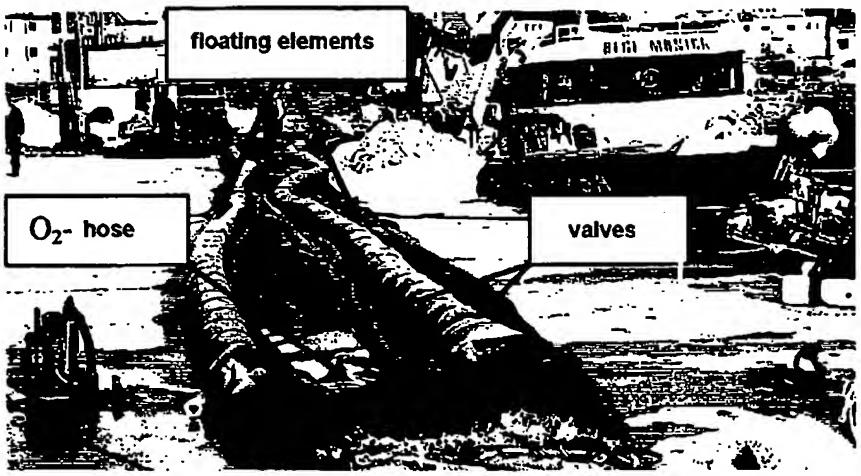


Figure 1: Principal sketch of the towing bag with its main components."

Translation of page 4:

"3.2 Phase 1: Towing without fish, 60 tons capacity

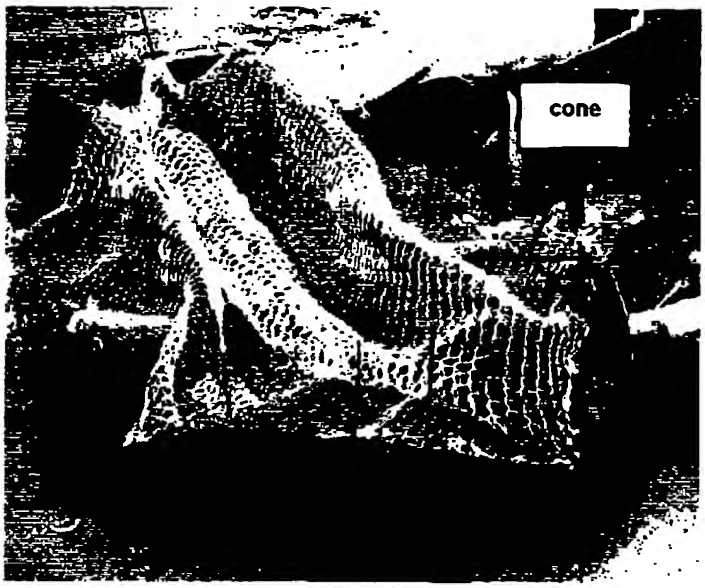
Floating elements and oxygen hoses were mounted while the bag was stretched on land (picture 1). On both sides of the bag there were welded in three longitudinal chambers with reinforced apertures. This solution was selected to be able to vary where the floating elements were to be secured. For the bag to achieve an approximately cylindrical form (10 meters circumference) during use, the floating elements were secured so that they were as close as possible to the top of the bag. The distance between the elements (centre-centre measurement) was 1.9 meters. The floating elements were inflated before they were welded to two of the chambers, one on each side of the element. The air-filling valves were placed directed upwards at the rear end of the bag.



Picture 1: The bag, viewed from the rear, stretched out on a quay for the mounting of floating elements. At the rear there are shown valves for the filling and emptying of air.

From the testing in autumn 2002 it was experienced that the oxygen level in the bag in connection with loading and deloading, became lower than wanted. Consequently it was decided that this version should be equipped with diffuser hoses to be able to add oxygen inside the bag. The diffuser hose (100 meters) was divided in two, bent double and connected so that it was possible to supply oxygen to the front and rear half of the bag, depending on the need. The supply hoses were led to the top of the bag through a separate opening, one meter from the rear opening of the bag (picture 1). During the handling the oxygen was to be supplied from bottles mounted in a rubber boat on the top of the towing bag. The system was not used during the tests being disclosed here.

Internally at the front of the bag there was mounted a cone (30 cm deep, 45° angle) which was to ensure that the bag opened quickly automatically even at a low water current. Additionally there were mounted a netting adjusted to fit the front opening of the bag (figure 2). The linen was selected based on the expected size of the pollack which later were to be transported in the bag.

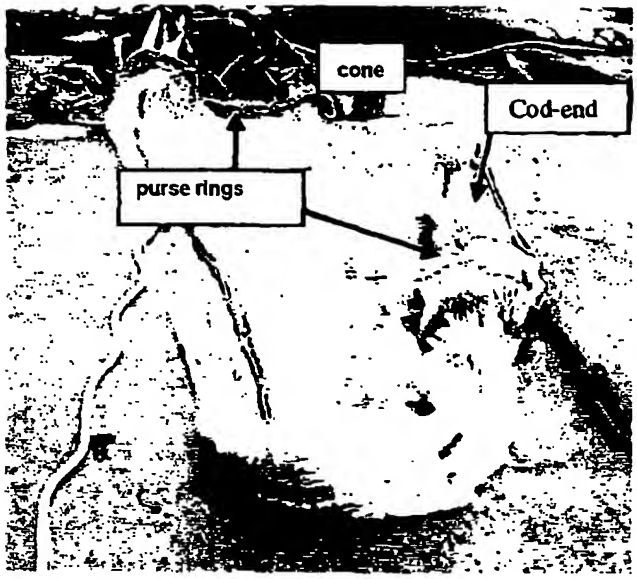


Picture 2: Netting and internal cone mounted at the front of the bag. The mesh size is elected based on the expected size of the pollack which later was to be transported.

The linen in the Danish seine extension at the rear end of the bag was selected after the same criteria (picture 3). The extension of the Danish seine was elected because it has a shape and function corresponding to what is wanted in the towing bag. In the extension of the rear end of the towing bag there was mounted a cone"

translation of page 5:

(1.2 meters deep) which reduced the opening from 10 to 8.4 meters in circumference. In addition there were mounted purse rings on the linen to allow further reduction of the opening.



Picture 3: Danish seine extension in a final mounting at the rear end of the bag. **In the transition between linen and webbing there are mounted purse lines with a rope making it possible to regulate the opening.**

The design of the towing ropes has a great impact on the function of the bag. Asymmetry and skewness leads to the bag becoming instable. In principle the towing ropes are built so that there are many securing points in the bag and that the number is halved (with a cock's foot) until they are assembled to a single towing rope. For each cock's foot the tow is extended with twice the diameter of the bag (corresponding to 6.4 meters). There were made 12 short cock's feet (approximately 1 meter) divided and secured to the bag (totally 12 points), and from these there were mounted 6 new cock's feet which again were divided on 3 more. These three were secured to a steel ring which was secured to the towing rope from the boat. The total length from the bag to the towing rope from the boat thus becomes 12 meters.

The bag, finally mounted, was launched to sea and made ready for towing. After some towing with an increasing speed of the boat, the front end proved to descend. This had as a consequence that the air in the floating elements became displaced to the rear and that the pressure thereby increased. After a short period of time that element exploded at the valves. The towing was aborted and the bag was taken on board for transport ashore. To counter-act the forces leading to the bag being dragged under water, here were mounted three standard fenders (F-11, approx. 150 litres each) between the floating elements on the front of the bag (picture 4). Additionally the lower part of the cone (approx. 25 % of the circumference) at the front of the bag cut open (inactivated).

Picture 4: Fenders mounted at the front of the bag.

The damaged parts after the explosion were cut off and new valves were mounted prior to the floating elements becoming re-welded. During the pressure testing after the repair there were discovered several small holes which sere repaired by welding. These holes had probably been created as a consequence of the bag being dragged along the quay deck in connection with the mounting. The experience shows that the floating elements must be protected in separate channels and be integrated into the bag itself. It will then be possible to change"

translation of page 6:

"the floating elements quickly at need. As a consequence of low pressure in the elements there were during the towing observed cases where the securing ropes completely or partially prevented the air to spread freely in the longitudinal direction of the floating elements. This would also be avoided if the elements were placed in sealed chambers.

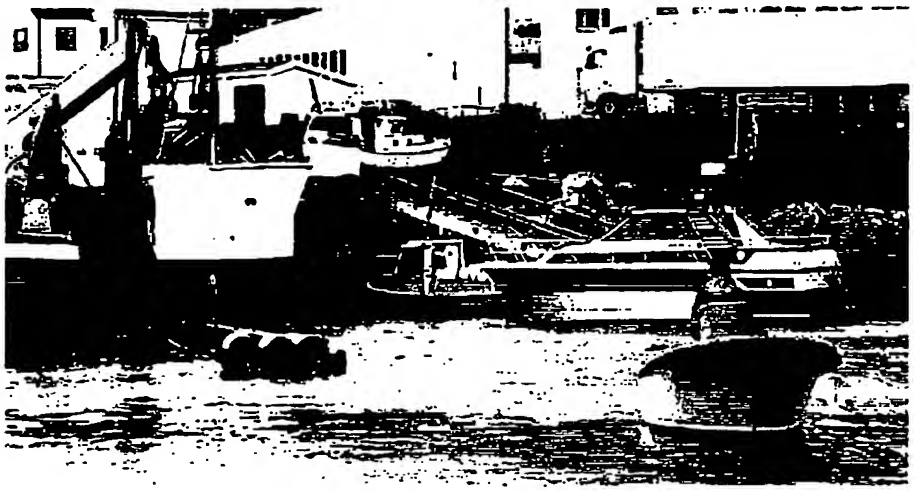
After repair and modification it was problematic to get the bag to open as it should. This was a consequence of too little air in the floating elements and a too large rear opening. Air was refilled, while the rear opening was reduced from 2.7 to 2 meters in diameter. After this adjustment the bag opened quickly and was filled in its entire length. After the speed of the towing having been increased to 4 knots (corresponding to 2 meters per second) there arose "snake movements" in the bag (the rear end swings back and forth). This effect became less pronounced by further reducing the rear opening, but still arose after sharp turns. The snake movement arises because the bag "bends" in sharp turns. The opening at the "bend point" is now less than the rear end of the bag, and the rear end of the bag is emptied. When the bag again is straightened out, it is again filled, but the snake movement may continue for 10 to 15 minutes. We are of the opinion that the "snake movement" is a consequence of the diameter of the bag becoming too small in relation to the length of the bag. During the last phase of this towing it was achieved a velocity of 5.6 knots (2.9 meters per second). There were not conducted measurements of the water velocity inside the bag during this phase of the test.

The experiences from this last test proved that the hydrodynamic properties of the bag were considerably improved by securing three fenders at the front of the bag. Simultaneously there were observed problems in keeping the shape of the bag even with a much reduced rear opening. The ratio between the diameter of the opening and the length of the bag is 1:16, whereas in the bag tested in the fall 2002 it was 1:8. It was also found that the bag, even after having been taken on board with triplex and packed as good as possible, took up too much space. It took 15 minutes to get the 50 meter bag on board, something which corresponds to the time it would have taken to empty the bag for fish. For the further tests it was thus decided that the length of the bag should be halved.

3.3 Phase 2: Towing without fish, 30 tons capacity

We chose to reduce the length of the bag from 50 to 25 meters, and ended ten up with a ration between opening and length of 1:8. Simultaneously the total weight of the bag was reduced from 1400 to 800 kilos (estimated values). The length of the bag was reduced by section of 25 meters from the middle being removed. The front and end sections were welded together. One of the diffuser loops for supplying oxygen to the bag was removed, whereas the second was adjusted to the new shape of the bag. The cone at the front of the bag, which in the first phase partly was inactivated (described in the previous paragraph), was repaired.

The bag now could be placed on the port side of the light boat. From this position the light boat managed to draw the bag out so that the crew on the boat could fill the floating elements with air (picture 5)



Picture 5: Deployment of bag with light boat."

Translation of page 7:

"The use of a gasoline-powered air blower has proven not to be optimal. In certain instances it has been difficult to start; additionally one is depending on having to operate both the blower and the valves simultaneously. These circumstances may under unfortunate conditions lead to it taking too long time to provide buoyancy to the towing bag, something which in its turn may lead to the bag beginning to sink. If the bag is to be used for towing fish directly from a seine it will be important that the readying of the towing bag takes a minimum of time. If this takes too much time there may arise mortality in the seine. The possibility of alternate solutions to the floating elements should be considered in the further development of the product.

Picture 6: The light boat tows at the speed of 1 knot. The position and shape of the floating elements shows that the bag is filled.

After the restructuring of the bag it was put to sea by the aid of the light boat. The bag opened and was immediately filled after it was liberated from MS Hege Monica. The GPS-logger on the following boat ("Kobben") showed that the light boat managed to tow the bag at about 1 knot velocity (picture 6). After having tested the bag over a shorter distance we found that it functioned optimally both with respect to filling and hydrodynamic properties.

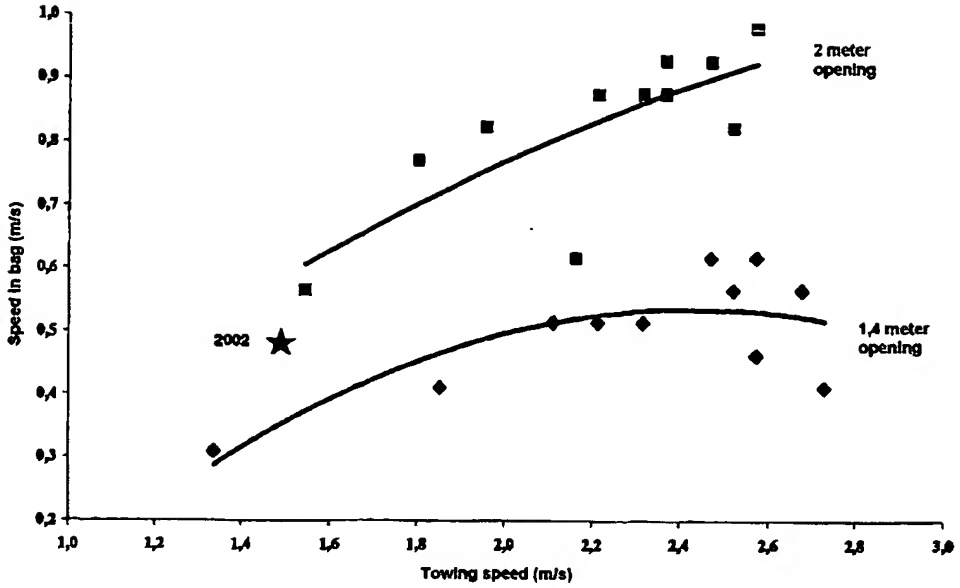
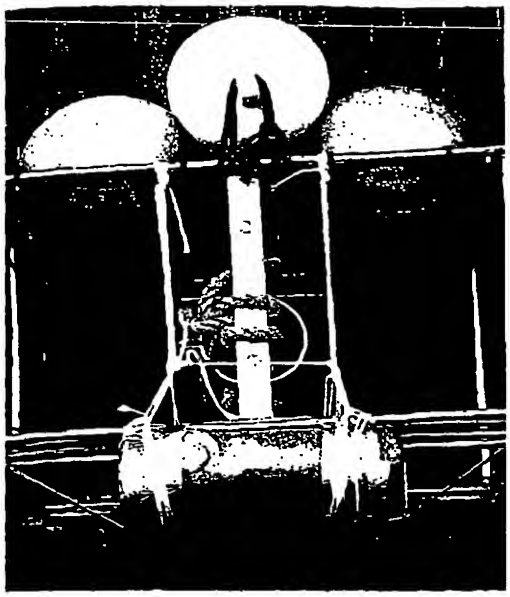


Figure 2: Current velocity inside the towing bag at different towing speeds. The measurements have been conducted with 2 and 1.4 meter opening at the rear of the bag. The speed is described as meters per second, where 1 meter per second corresponds to 1.94 knots. The star indicates the results obtained in the test in fall 2002."

Translation of page 8:

"After this preliminary test a Scanmar current indicator (Scanmar grid sensor HC4 GS-01, picture 7) mounted 10 meters from the rear end of the bag. This sensor transferred current measurements wireless from the interior of the bag to a receiver towed after the boat at a depth of two meters, two meters from the ships side. The registering was read on a separate logger located at the bridge of "Hege Monica". There were conducted two towing sequences wherein the rear opening was 2 and 1.4 meters in diameter, respectively (figure 1). With a rear opening of 1.4 meters the current velocity inside the bag was 0.5 m/s (1 knot) while the boat kept a speed of 2.6 m/s (5 knots). With the same speed of the boat, but with an opening of 2 meters, the velocity inside the bag had increased to 1 m/s (2 knots). After the measurements had been conducted the bag was taken on board in 6.5 minutes.



Picture 7: Rig with Scanmar current registrator for measuring the water velocity inside the towing bag.

The results show that by regulating the rear opening it is possible to obtain an increased velocity inside the bag. In this case we had as goal to transport seine-caught pollack with an estimated size of 50 cm (approx. 1 kilo) with a current speed corresponding to one body length per second. Figure 1 shows that with an opening of 1.4 meters in diameter the velocity inside the bag is about one body length, i.e. 50 cm. The speed of the towing will be 2.5 meters per second (5 knots). **In comparison with towing in traditional bags the new towing bag gives a 4 to 5 times greater speed. In practice this has as a consequence that a towing which previously took 30 hours, this will now, by using the newly developed towing bag, be possible to do in 6 to 7.5 hours.**

3.4 Towing with 20 tons pollack in the bag

In week 41 the lasts test were to be conducted. Primo October is at the very end of the pollack fishing and many of the coastal seine ships were made ready for the herring fishing in the Vestfjorden. The only possibility of delivering in the area (Western Finnmark) was two Russian fabric vessels near Hammerfest.

After some misses, we got a catch of about 30 tons (estimated after the catch had been drawn along the ship's side). Even if it had only taken 10-12 minutes previously to deploy the towing bag, this time we got problems with the starting of the air blower for the filling of air. Thus it took more than 25 minutes before the bag had been deployed by the aid of a light boat. The bag was then towed around MS Hege Monica and into position for being mounted to the seine. The positioning of a transfer channel from the seine to the towing bag also took a longer time than anticipated. All in all the pollack

catch of 30 tons had been lying at the ship's side for about an hour before the fish finally were transferred to the towing bag, partly passively, partly swimming. There were approximately 2-3 tons of pollack which was left behind floating at the rear of the Danish seine extension when the towing started.

The pollack sought to the front of the bag immediately after the towing had started. The camera inspection at the front of the bag showed that the pollack were at the very front at the seine panel. There was a relatively large portion of pollack around 40 cm and this had as a consequence that the about 40% of the pollack was selected through the panel at the front"

Translation of page 9:

"and the transfer channel. Unfortunately also a part of the pollack had become stuck in the seine panel. The towing proceeded normally, but since it now had become dark the bag was not towed at speeds over four knots.

The emptying of the towing bag was done by using a fish pump mounted at the end of the transfer channel, while the bag was dried through Triplex. The emptying proceeded quickly and effectively and the catch was then delivered to the fabric vessel.

Unfortunately this was the only full scale test. The results are, however, satisfactory for the most central questions, while others probably need a repetition in 2004."

Translation of page 10:

"**4. CONCLUSIONS**

4.1 Speed

The bag, as it appears today, satisfies the goal of increased towing speed. With a towing speed exceeding five knots the time for moving ones own catch has been reduced with 75-80% in comparison to traditional towings. This is a two knot improvement with respect to the tests in 2002. The capacity in the restructured bag is at least 30 tons. The basic goals for the bag are thus achieved.

4.2 Construction

For the main part of the bag, cylinder and **"cones" at both ends,** we are satisfied with today's construction. The ratio between diameter and length is 1:8. The ratio between the opening area at the front and rear of 5:1 (8 m^3 at the front and 1.5 m^3 at the rear) reduces the speed outside and inside the bag with the same ratio (five knots towing speed gives one knot inside the bag). For reduction in other parts of the speed interval, see figure 2.

4.3 Selection of material in the bag

The selected material in the 2003-tests is still too heavy and voluminous. Even with a reduced pore size it becomes cumbersome and takes up too much space onboard the vessel. This material is also comparatively expensive and the total costs for a 40 ton bag is still outside a realistic cost acceptance in the fleet (NOK 150.000,-) Prices collected in 2003, from new producers and by using alternative materials (airbag fabric), indicate that a 40 ton bag may be produced for less than NOK 40.000,- exclusive note linen and ropes. This will be a price able to compete.

4.4 Transfer, seine linen and selection

The experiences with the transfer of fish from seine to towing bag became very limited. However, it was discovered that the transfer channel (the Danish seine extension) is too long, but functional if the bag is mounted quickly enough (maximum 15 minutes after ended seine throw). Seine linen that was used in the transfer channel and the front panel had too large meshes. Additionally, the pollack "clothed" the meshes. This indicates that the selection areas should be designed as the panel after a trawl model (flexigrid or square linen – Ultra Cross)."

Translation of page 11:

"5 SUGGESTIONS FOR FURTHER DEVELOPMENTS

The experiences from the testing of the towing bag show that it has to be developed further as a product to make the transfer of fish more effective and to adjust selection panels removing undersized/small fish. This is a job we believe to be best conducted through cooperation between Fish Supply AS, the Fishery Science Institute ("Responsible Fishing") and coast seine fishers wanting to take the new technology into use.

In the conducting of the tests being described in this report there was focused on developing a functional towing bag. This had as a consequence unpredicted situations in the form of rebuilding and repairs before the bag functioned satisfactory. The planned activity being associated with the physiological and quality tests of the pollack in the bag was therefore given a lower priority. The Fishery Science institute considers this as important to do and hopes to do this work in later projects.

- The combining of catch/towing and storage/feeding did not succeed in 2003 (FHF-project "Storage and feeding of pollack"). The pollack being caught in fall 2003 was too small and consequently of little interest for the process industry (mainly in Vesteraalen). Within the remaining means for the project being described here, we have chosen to produce a smaller version of the bag (1.5 meters in diameter and 12 meters long) in "air-bag" fabric. This bag has constant buoyancy and will have a capacity of about 4 tons of fish. With such a bag we will be able to conduct studies on several of

the species (salmon, cod, mackerel, herring and tuna) which may be subject to transport with the new technology. We hope in this way to be able to provide knowledge assisting the transport bag, both nationally and internationally. Additionally such an activity will provide important knowledge about new methods for the transport of live fish."